

Description of *Eunice weintraubi* and *E. wui*, two new species of eunicid polychaetes from northern Gulf of Mexico

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Abstract.—*Eunice weintraubi* and *Eunice wui* are described from shallow waters of the Gulf of Mexico and variability of morphological characters is discussed. Because large numbers of specimens are available, some features of the ontogeny of *Eunice wui* are also noted. The morphological characters of two related species, *Eunice fauchaldi* and *Eunice multicylindri* are compared to each other and to *Eunice wui*.

Eunicid polychaetes from the Gulf of Mexico were studied by Gathof (1984) based on benthic surveys off Florida, Louisiana and Texas. The specimens from these surveys and other, similar surveys were deposited in the Smithsonian Institution. A study intended to verify the accuracy of identifications showed that many of the previous identifications were inaccurate at the species level. The specimens here studied were in part those reported by Gathof (1984), but much of the material has never before been reported in a systematic study.

The morphological terminology was defined in Fauchald (1992) except for interpretation of the prostomial appendages. Traditionally these have been considered as one to five occipital antennae; terms such as outer lateral, inner lateral and median antennae have been used (Fauchald 1992 used the abbreviations AI-AIII) for the antennae, and other terms may be found in the literature (Fauvel 1923, Hartman 1944). Orrhage (1995), based on innervation, demonstrated that the outer lateral antennae (=AI) are homologous with palps in other polychaetes. Consequently, the eunicids have three antennae: a median antenna and paired lateral antennae. Orrhage also suggested that the so-called frontal antennae (Fauchald 1982a) or frontal palps (Paxton 1986) of onuphids

are paired dorsal lips. This finding has consequences for our understanding of the eunicid prostomium. The anterior end of the head in eunicids is usually notched or bifid. Positionally, this notch corresponds to the cleft between the dorsal lips of the onuphids. If the cleft portion of the eunicid head corresponds to the onuphid dorsal lips, the position of the antennae can no longer be considered occipital. Instead the eunicid antennae become located in much the same position as in other polychaetes (e.g., hesionids, syllids and scale-worms). The eunicid prostomial appendages are here renamed to include a median and paired lateral antennae and a pair of palps usually found lateral to and in front of the lateral antennae.

All the specimens were observed under stereo and compound light microscopes; sketches for the illustrations were made using camera lucida.

Eunice weintraubi, new species
Figs. 1a-h, 2

Materials examined.—Holotype: USNM 090037, off Panama City, Florida, MAFLA, 37 m, STA V-2528, 29°54'59"N, 86°04'59"W, Feb. 1978. Paratype: USNM 090037 ($n = 1$, STA v-2528); USNM 090039 ($n = 3$, STA 2528).

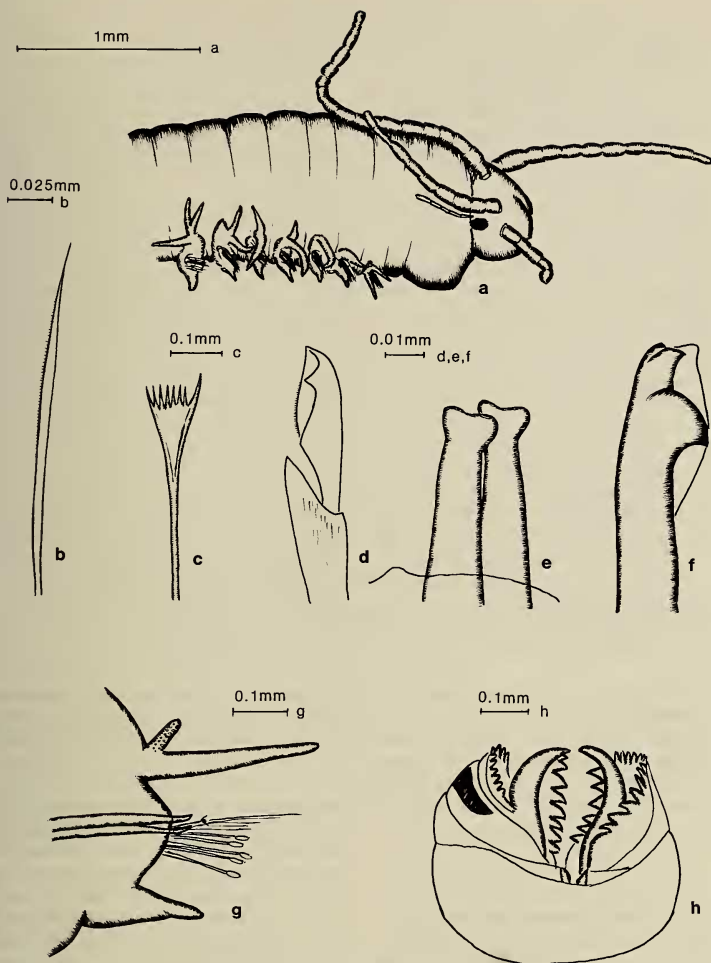


Fig. 1. *Eunice weintraubi*, new species: a, anterior end (Paratype USNM 090039), lateral view; b, limbate chaeta; c, pectinate chaeta; d, compound falciger; e, hammer-headed aciculae, 30th chaetiger; f, subacicular hook, 25th parapodia; g, 25th parapodium, anterior view; h, maxillae (Paratype USNM 090039).

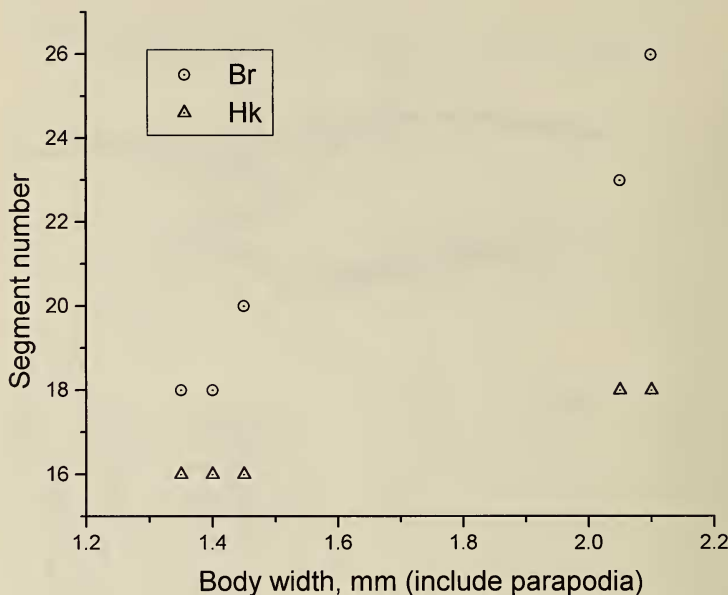


Fig. 2. The size-dependent variation of the ending position of chaetiger with branchiae (Br) and the start position of subacicular hook (Hk) in type specimens of *Eunice weintraubi*, new species.

Description.—The holotype (Fig. 1a) is a complete specimen with 74 chaetigers, the total length is 13.5 mm; the first 10 chaetigers measure 1.8 mm in length, the widest part measures 1.6 mm without parapodia (2.1 mm with parapodia). As preserved, the specimen is pale without distinct color patterns.

Distal end of prostomium clearly notched (i.e., a sulcus present, but very short). Prostomium shorter and narrower than peristomium, a little less than half the length of peristomium. One pair large black eyes situated outside lateral antennae behind the palps. Palps and antennae evenly spaced. Palps a little thinner than antennae. Styles of antennae and palps with moniliform articulations that become drop-shaped distally. Palpostyles have four articulations and

palps reach first chaetiger. Lateral antennae with ten articulations and reaching third chaetiger. Median antenna with 14 articulations, it reaching chaetiger 6. Anterior ring of peristomium about $\frac{1}{5}$ total length of peristomium; separation between first and second ring is clear dorsally and ventrally. Peristomial cirri with several articulations, reaching posterior end of prostomium.

Anterior notopodial cirri finger-shaped, always longer than ventral cirri, with indistinct articulations. First two pairs of ventral cirri slender; ventral cirri with ovate base from third parapodium to middle region of the body, becoming digiti-form toward the posterior.

Branchiae first appear from fourth chaetiger; end on chaetiger 26. Where best developed, around chaetiger 10, pectinate

branchiae with four filaments, first and last several (Fig. 1g) branchiae with single filament. Both branchiae and individual filament shorter than notopodial cirri.

Limbate chaetae (Fig. 1b) marginally serrated. Pectinate setae (Fig. 1c) with 6–9 teeth, one outer tooth slightly longer than other teeth. Compound falcigers (Fig. 1d) with two teeth; distal tooth strongly curved and pointing in same direction as proximal tooth. Proximal tooth slightly larger than distal one. Guards lack mucros, but distally asymmetrically bluntly pointed and basally serrated. Shafts of compound falcigers marginally serrated, with a distinct core. Pseudocompound falcigers and compound spinigers absent. Neuropodia usually with two yellow aciculae; they blunt-tipped anteriorly, becoming hammer-headed (Fig. 1e) from about chaetiger 20, becoming blunt-tipped or pointed in last few chaetigers. Subacicular hooks (Fig. 1f) present from chaetiger 18; always single, yellow and tridentate with distinct hoods. The teeth form a crest and increase in size from distal tooth to proximal tooth.

Two pairs of anal cirri present; dorsal pair long and finger-shaped and as long as last seven chaetigers; ventral pair only $\frac{1}{8}$ length of dorsal pair.

Maxillae not examined in holotype; in paratype (USNM 090039, fig. 1h), maxillae formula: 1 + 1, 8 + 6, 7 + 0, 11 + 8, 1 + 1.

Variation of morphological characters (Fig. 2).—In all five specimens examined, the starting position of the branchiae is always chaetiger 4; but the ending position appears size-dependent, varying from chaetiger 18 to 26. The maximum number of branchial filaments is three or four. The first occurrence of subacicular hooks also appears size-dependent, starting from chaetiger 16 in a 1.4 mm-wide (at the widest part, including parapodia,) specimen to chaetiger 18 in a 2.1 mm-wide specimen.

Discussion.—The specimens of *E. weintraubi* studied by Gathof (1984) were identified as *Eunice antennata*. According to the

revision of the genus *Eunice* by Fauchald (1992), these specimens differ from *E. antennata* in the following characters: Branchiae are present from chaetiger 4 in *E. weintraubi* and not until chaetiger 7 in *E. antennata*; they are present on less than half of the total chaetigers in *E. weintraubi* and are present to near the posterior end in *E. antennata*. Furthermore, the limbate setae are marginally serrated in *E. weintraubi*, rather than smooth as in *E. antennata*.

Eunice weintraubi resembles *Eunice papeetensis* Chamberlin from Tahiti and *Eunice pellucida* Kinberg from the West Indies. It differs from *E. papeetensis* in that it has pectinate branchiae; in *E. papeetensis* the branchiae are palmate. *E. weintraubi* has branchiae from chaetiger 4; *E. papeetensis* has branchiae from chaetiger 6. *Eunice weintraubi* differs from *E. pellucida* in that eyes are present rather than absent. Branchiae always appear from chaetiger 4 in *E. weintraubi* rather than from chaetigers 5–6 as in *E. pellucida*. The maximum number of branchial filaments is only four in *E. weintraubi*, rather than eight as in *E. pellucida*, in similarly sized specimens. Finally, the median antennal style has up to 30 rings in *E. pellucida* and only 14 in *E. weintraubi*.

Etymology.—The species is named for the late Dr. Robert Weintraub, former Professor of Zoology, George Washington University, for his contribution to systematic zoology.

Eunice wui, new species

Figs. 3a–h, 4–6

Materials examined.—Holotype: USNM 129729, off Florida, Gulf of Mexico, SOFLA, 14 m, STA 52, 25°17'48"N, 81°39'48"W, 10 Dec. 1982. Paratypes: Gulf of Mexico, off Florida, SOFLA : USNM 090032 ($n = 8$, 24 m, STA 2), USNM 112103 ($n = 2$, 16 m, STA 43), USNM 129729 ($n = 32$, 14 m, STA 52), USNM 129777 ($n = 40$, 14 m, STA 52), USNM 130071 ($n = 17$, 14 m, STA 52), USNM 130126 ($n = 5$, 14 m,

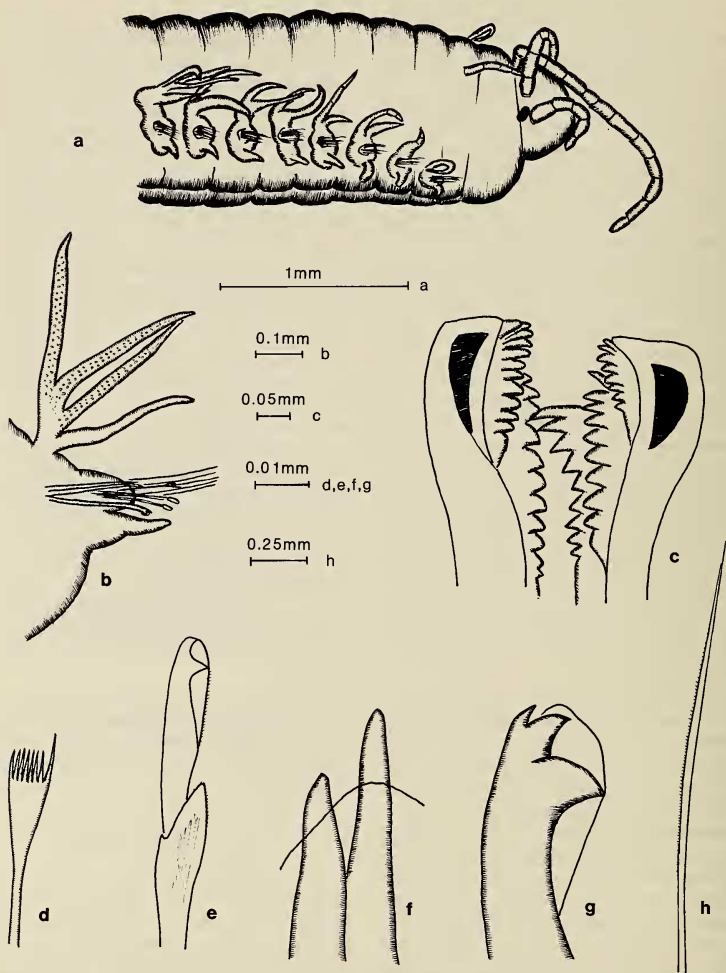


Fig. 3. *Eunice wui*, new species: a, anterior end (Paratype USNM 129729), lateral view; b, 32rd parapodium, anterior view; c, limbate chaeta; d, pectinate chaeta; e, compound falciger; f, aciculae; g, subacicular hook, 32rd parapodium; h, maxillae, (paratype USNM 129729).

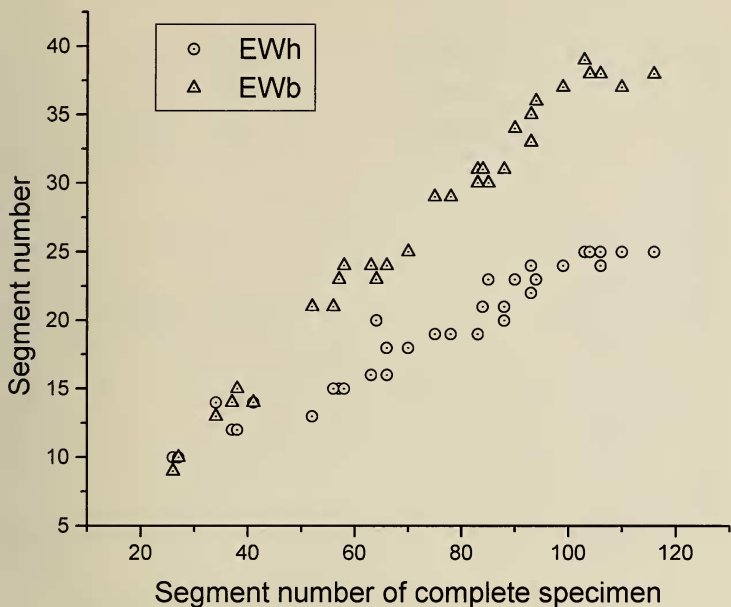


Fig. 4. Relationships between the first occurrence of the subacicular hook (EWh), the ending position of the branchiaed chaetiger (EWb) and the number of chaetigers in *Eunice wui*.

STA 52), USNM 130185 ($n = 1$, 14 m, STA 52), USNM 130254 ($n = 5$, 14 m, STA 52), USNM 130330 ($n = 21$, 14 m, STA 52), USNM 130424 ($n = 3$, 14 m, STA 52), USNM 130515 ($n = 5$, 14 m, STA 52), USNM 130551 ($n = 11$, 10 m, STA 50; Gulf of Mexico, Texas, Southern Bank, STOCS: USNM 090033 ($n = 1$, 82 m, STA SB3, 27°26'06"N, 096°31'47"W, Dec. 1976), USNM 090034 ($n = 1$, 75 m, STA HR1), USNM 090035 ($n = 1$, 75 m, STA HR1), USNM 090036 ($n = 6$, 75 m, STA HR1).

Description.—Holotype specimen (Fig. 3a) complete, with 110 chaetigers, tapering abruptly from the posterior part. Length is about 25 mm; first ten chaetigers 2.3 mm;

widest part 1.1 mm without parapodia (1.8 mm with parapodia).

Prostomium anteriorly rounded; median sulcus very shallow dorsally but forming a deep groove on ventral side. Prostomium slightly narrower than peristomium, about same length and about $\frac{1}{2}$ depth of peristomium; small specimens with relatively thicker prostomia. One pair eyes present behind palps. Palps and antennae similar in thickness; palps and lateral antennae slightly closer to each other than lateral antennae are to median antenna. All styles with cylindrical rings. Palps with six rings and reaching middle of second peristomial ring. Lateral antennae with nine rings and reaching posterior end of chaetiger 4. Median an-

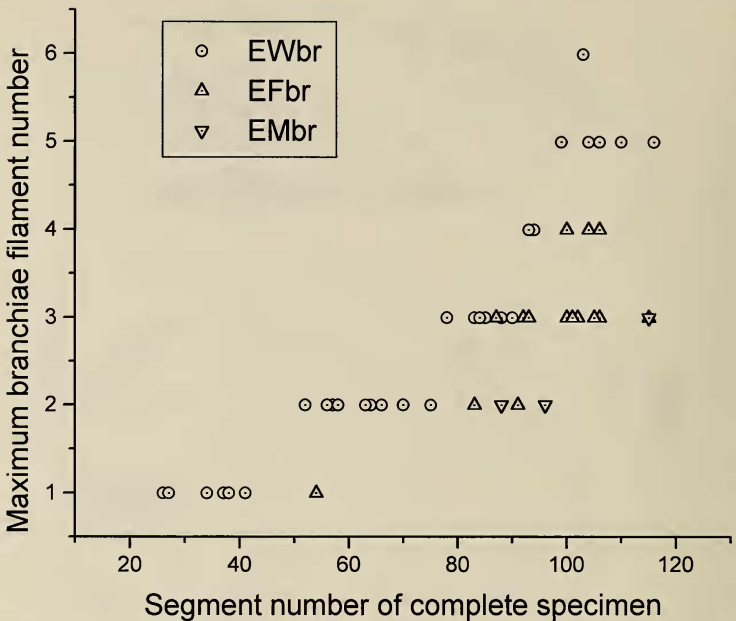


Fig. 5. Relationships between the maximum number of branchiae filament number and the number of chaetigers for *Eunice wui*, new species (EWbr), *E. fauchaldi* (EFbr) and *E. multicylindri* (EMbr).

tenna with 11 rings and reaching chaetiger 7. First peristomial ring is approximately $\frac{2}{3}$ total length of peristomium. Peristomial cirri small, with about six articulations and reaching middle of prostomium.

Dorsal cirri long digiti-form, always longer than ventral cirri; become slender in posterior end of body. Anterior dorsal cirri with irregular articulations. Ventral cirri with ovate inflated bases in anterior-median parapodia; inflated bases decreasing in size from about chaetiger 30 (Fig. 3b). Ventral cirri digiti-form posteriorly.

Branchiae begin on chaetiger 3, end at chaetiger 38. First four and last branched chaetigers with only one filament, all other branchiae with at least two filaments and a maximum of five filaments in a pectinate

arrangement from chaetigers 14 to 23. Branchiae present on approximately $\frac{1}{3}$ of total number of chaetigers. Most branchiae (stem + filament) slightly longer than dorsal cirri except on first several and last few branched chaetigers.

Limbate chaetae (Fig. 3c) marginally serrated. Pectinate chaetae (Fig. 3d) with one lateral tooth much longer and thicker than other teeth; number of teeth varies from 5–8. Compound chaetae (Fig. 3e) yellow and bidentate; guards with short bluntly pointed heads and basally serrated, lacking mucros; edge of shaft also serrated. Pseudocompound falciger and compound spiniger absent. Aciculum (Fig. 3f) always paired; distally bluntly pointed, some with a pointed sheath. Subacicular hooks (Fig. 3g) start in

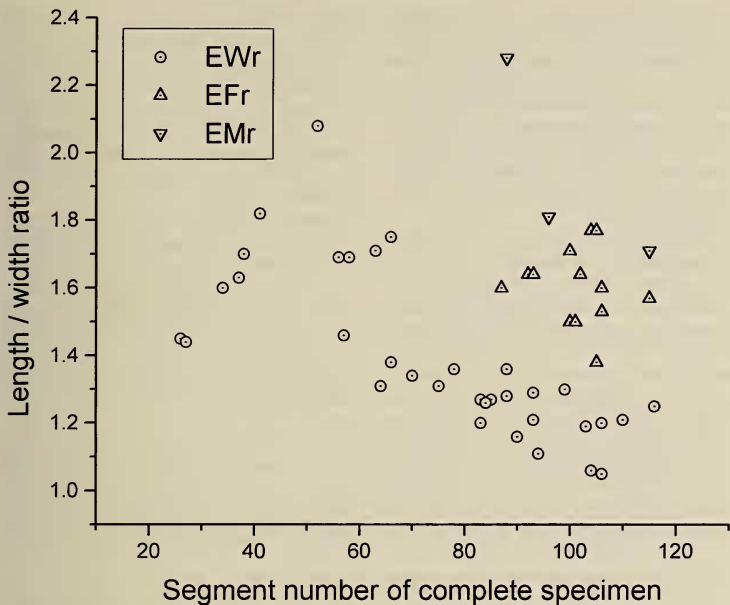


Fig. 6. Relationships between the Length/Width ratio and the number of chaetigers in *Eunice wui* new species (EW r), *E. fauchaldi* (EFr) and *E. multicylindri* (EM r).

chaetiger 25; yellow and tridentate; teeth in a crest increasing in size from distal to proximal tooth. Subacicular hooks always single except where replacement hooks have formed; stouter than aciculae.

Two pairs anal cirri present; larger dorsal pair is as long as last five chaetigers, ventral pair only $\frac{1}{3}$ length of dorsal one.

Maxillae not examined in holotype; maxillae of paratype (USNM 129729, Fig. 3h) poorly sclerotized, nearly transparent; with formula: 1 + 1, 11 + 9, 0 + 8, 11 + 9, 1 + 1.

Variation in morphological characters.—168 specimens examined, with 36 of these complete, including both juveniles and adults. It is thus possible to delimit cer-

tain ontogenetic patterns. These patterns include the following:

Palps: In USNM 129777, there are two complete juveniles with 26 and 27 chaetigers respectively; both of these have three antennae but lack palps. In the same lot, there are two complete specimens, with 37 and 38 chaetigers respectively, in which the palps are present. Similarly, in USNM 129972 a 34-chaetiger specimen has the three antennae and the palps. Consequently, it appears that palps of *E. wui* do not emerge until they have reached more than 27, but fewer than 34 chaetigers.

Peristomial cirri: Specimens with 26 and 27 chaetigers (USNM 129777) lack peristomial cirri; a pair of very short cirri is pres-

ent in specimens with 34, 37 and 38 chaetigers. The development of the peristomial cirri appears to be simultaneous with that of the palps. The length of the cirri varies from a small protuberance in specimens with less than 34 chaetigers, to reaching the first peristomial ring in specimens with 65 chaetigers, while reaching the middle of the prostomium in specimens with more than 100 chaetigers.

Eyes: Eyes are present in all specimens, but change in color from light red in juveniles to black in large specimens.

Branchial pattern: Branchiae are always present from the third chaetiger independent of the size of the specimen. The numbers of pairs of branchiae and the maximum number of filaments are size-dependent (Figs. 4, 5). For example, in a 26-chaetiger juvenile, branchiae are present in chaetigers 3 through 9, all having only a single filament; on the other hand, in a 116-chaetiger specimen, branchiae are present from chaetigers 3 through 39, with a maximum of five filaments. Usually, *E. wui* has a maximum of two branchial filaments by the time they reach 50 chaetigers, a maximum of three filaments at about 75–80 chaetigers, a maximum of four filaments at 90 chaetigers, and a maximum of five or even six filaments when they reach 100 chaetigers.

Subacicular hooks: Subacicular hooks are always single, yellow and tridentate. The starting position (Fig. 4) is size-dependent. They appear from chaetiger 10 in a 26-chaetiger juvenile, but from chaetiger 25 in a 116-chaetiger adult.

From Figs. 4 & 5, the approximate total chaetiger number of an incomplete specimen can be estimated either by the numbers of pairs of branchiae or the starting position of subacicular hooks, or by a combined estimate using the above factors.

Length/width ratio: From Fig. 6, it is obvious that the length/width ratio of *E. wui* changes during its development. The ratio increases with the increasing number of chaetigers, it reaches a peak for a 50-chaetiger specimen. From there the ratio de-

creases steadily as more chaetigers are added. For example, the length ratio is about 1.45 for a 26-chaetiger specimen, 2.08 for a 51-chaetiger specimen, and 1.25 for a 116 chaetiger one. Thus, before a specimen of *E. wui* reaches 50 chaetigers, its length increases relatively faster than the width; thereafter, its width increases relatively faster than the length.

Based on the information about variation in morphological patterns, we believe it may be useful to recognize three stages:

Early juvenile stage, from metatrochophore stage until the juveniles reach about 30 chaetigers. Characteristic of this stage are absence of palps and peristomial cirri, branchiae with only single filament and the body length growing relatively faster than the width.

Late juvenile stage, from about 30 chaetigers to about 50 chaetigers. The juvenile retains the branchial pattern and growth pattern of the early juvenile, but has at this stage developed both palps and peristomial cirri.

Adult stage, in which the specimen has at least 50 chaetigers. Characteristic of this stage is branchiae with two or more branchial filaments and body width increases relatively more rapidly than body length.

Discussion.—This species was listed as *Eunice vittata* (Fauvel 1923, Fauchald 1992) by Gathof (1984). It differs from *E. vittata* most notably in that subacicular hooks are always single, not multiple as in *E. vittata*. Furthermore, in specimens with similar chaetiger counts, the maximum number of branchial filaments is strikingly different: In a 75-chaetiger *E. vittata* a maximum of 12 filaments is present, but in a specimen of *E. wui*, with a similar chaetiger count, only three filaments are present.

Eunice wui resembles *Eunice fauchaldi* Miura from Japan and *Eunice multicylindri* Shisko from the Californian coast. Paratype material of both species (20 specimens of *E. fauchaldi*, of which 13 are complete; 7 specimens of *E. multicylindri*, of which three are complete) were available for ex-

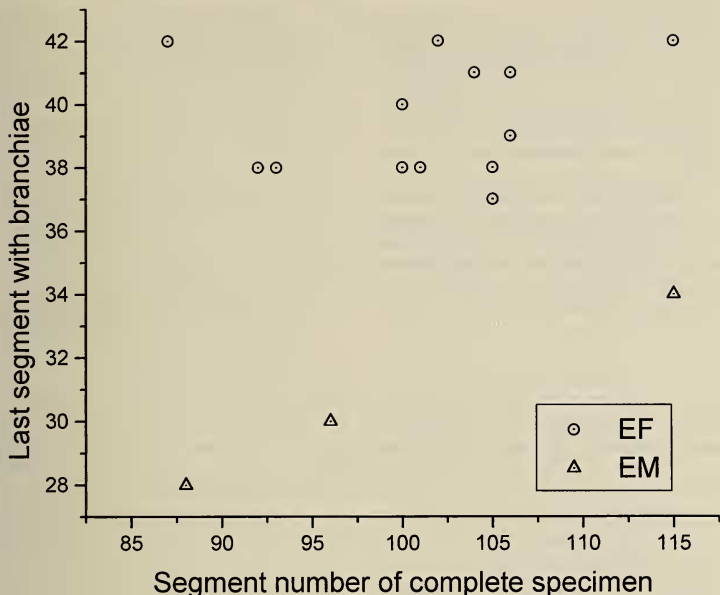


Fig. 7. Relationship between the numbers of pairs of branchiae and the number of chaetigers for *Eunice fauchaldi* (EF) and *E. multicylindri* (EM).

amination. Variations in morphological characters were compared with those of *E. wui*. Figs. 5 and 6 show that *E. wui* differs from these two species in the following features: in similarly sized (same width) specimens, *E. wui* has a higher number of branchial filaments than the other two species (Fig. 5). For example, at 100–116 chaetigers, the average maximum number of filaments of *E. wui* ($n = 7$) is 5.1; in *E. fauchaldi* ($n = 10$) it is 3.3, and in *E. multicylindri* (only one specimen with 116 chaetigers) only 3 filaments. The length/width ratio is different (Fig. 6). For a similarly sized specimen, the new species appears stouter than the others. For example, at 100–116 chaetigers, the average maximum length/width ratio of *E. wui* ($n = 7$) is 1.17,

that of *E. fauchaldi* ($n = 10$) is 1.60, and *E. multicylindri* ($n = 1$, 116 chaetigers) has a ratio of 1.71.

In both *E. fauchaldi* and *E. multicylindri* branchiae start on chaetiger 3, but the numbers of pairs of branchiae are different (Fig. 7). For example, a 115-chaetiger *E. fauchaldi* specimen has branchiae from chaetigers 3 through 42, but in a specimen of *E. multicylindri* with a similar chaetiger-count (116 chaetigers), branchiae are present from chaetigers 3 through 34 only.

Morphometric studies on polychaete worms have already been conducted by many workers, including Fauchald (1982b, 1991), Mackie (1984), and Sigvaldadóttir & Mackie (1986). Those previous papers and the current study indicated that certain mor-

phological characters of the polychaetes vary in a size-dependent fashion. Whenever material is available, a statistical study is highly recommended, it will not only help clarify relations among similar species later, but will also help to identify phylogenetically important characters, and may yield ecologically interesting results.

Etymology.—This species is named in honor of Professor Baoling Wu, Honorary Director of the First Institute of Oceanography, SOA, China, for his many contributions to the study of polychaetes, and in appreciation of his several years of guidance to the first author.

Acknowledgments

The authors would like to thank Jon Norrenburg, Linda Ward, Cheryl Bright, Bill Moser and other colleagues from the Division of Worms, NMNH, Smithsonian Institution and the Systematic Group, Department of Biological Sciences, George Washington University. Frederick Pleijel and an anonymous referee improved greatly the manuscript. This research was supported by contracts from the Mineral Management Services, Department of Interior and the Smithsonian Institution, especially contract # F96 22-uu-03599. The first author is also supported by the Weintraub Fellowship from the George Washington University.

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